THE INDUSTRIAL ORGANIZATION OF MARKETS WITH TWO-SIDED PLATFORMS

David S. Evans and Richard Schmalensee[*]

Many diverse industries are populated by businesses that operate "two-sided platforms." These businesses serve distinct groups of customers who need each other in some way, and the core business of the two-sided platform is to provide a common (real or virtual) meeting place and to facilitate interactions between members of the two distinct customer groups. They play an important role throughout the economy by minimizing transactions costs between entities that can benefit from getting together. In these businesses, pricing and other strategies are strongly affected by the indirect network effects between the two sides of the platform. As a matter of theory, for example, profit-maximizing prices may entail below-cost pricing to one set of customers over the long run and, as a matter of fact, many two-sided platforms charge one side prices that are below marginal cost and are in some cases negative. These and other aspects of two-sided platforms affect almost all aspects of antitrust analysis—from market definition, to the analysis of cartels, single-firm conduct, and efficiencies. This chapter provides a brief introduction to the economics of two-sided platforms and the implications for antitrust analysis.

1. Introduction

Many diverse industries are populated by businesses that operate "two-sided platforms." These businesses serve distinct groups of customers who need each other in some way, and the core business of the two-sided platform is to provide a common (real or virtual) meeting place and to facilitate interactions between members of the two distinct customer groups. Two-sided platforms are common in old-economy industries such as those based on advertising-supported media and

[*] Evans is Chairman of eSapience, Ltd. In Cambridge MA, Managing Director of the Global Competition Policy Practice at LECG, Cambridge, MA and Executive Director of the Jevons Institute for Competition Law and Economics and Visiting Professor at University College London. Schmalensee is Professor of Economics and Management at the Massachusetts Institute of Technology (MIT) and the John C Head III Dean of the MIT Sloan School of Management.

new-economy industries such as those based on software platforms and web portals. They play an important role throughout the economy by minimizing transactions costs between entities that can benefit from getting together.

In these businesses, pricing and other strategies are strongly affected by the indirect network effects between the two sides of the platform. As a matter of theory, for example, profit-maximizing prices may entail below-cost pricing to one set of customers over the long run and, as a matter of fact, many two-sided platforms charge one side prices that are below marginal cost and are in some cases negative. These and other aspects of two-sided platforms affect almost all aspects of antitrust analysis—from market definition, to the analysis of cartels, single-firm conduct, and efficiencies.[1] This chapter provides a brief introduction to the economics of two-sided platforms and the implications for antitrust analysis.

Two-sided platforms were first identified clearly in pioneering work by Jean-Charles Rochet and Jean Tirole, which began circulating in 2001.[2] A significant theoretical and empirical literature quickly emerged, and the subject has become a very active area of research in economics.[3] For the purposes of this chapter, it is helpful to clarify some terminology that is used in the economics literature and which sometimes causes confusion. Rochet and Tirole used the term "two-sided markets" to refer to situations in which businesses were catering to two interdependent groups of customers. The term "market" was meant loosely and does not refer to how that term is often used in antitrust. This chapter refers to "two-sided platforms" but it is synonymous with "two-sided markets" as used in much of the economics literature. What "market" a two-sided platform competes in, from an antitrust perspective, is one of the questions considered here.[4] Two-sided platforms often compete with ordinary ('single-sided") firms and sometimes compete on one side with two-sided platforms that serve a different second side.

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[1] *See* David S. Evans, *The Antitrust Economics of Multi-Sided Platform Markets*, 20 YALE J. ON REG. 325 (2003) and Julian Wright, *One-Sided Logic in Two-Sided Markets*, 3 REV. OF NETWORK ECON. 44 (2004).

[2] Jean-Charles Rochet & Jean Tirole, *Platform Competition in Two-Sided Markets*, 1 J. OF EUR. ECON. ASS'N 990 (2003). Some of the key issues were identified in the context of payment cards in an important contribution William F. Baxter, *Bank Exchange of Transactional Paper: Legal and Economic Perspectives*, 26 J.L. & ECON. 541 (1983). There are also literatures for particular industries that also provide precursors.

[3] *See Competition Policy in Two-Sided Markets*, available at http://idei.fr/doc/conf/tsm/programme.pdf, for the program for a recent conference.

[4] Although, for the most part, we will use the term two-sided platform the reader should note that some platforms have more than two distinct groups of customers. Digital media platforms, for example, often have four: users, developers, hardware makers, and content providers.

2. Economic Background on Two-Sided Platforms

A heterosexual singles-oriented club offers some intuition on the economics of two-sided platforms. A nightclub, such as Bungalow 8 in Manhattan, provides a platform where men and women can meet and search for interactions and potentially dates. The club needs to get two groups of customers on board its platform to have a service to offer either one: it needs to get both men and women to come. Moreover, the relative proportion of men and women matters. A singles club with few women will not attract men, and a club with few men will not attract women. Pricing is one way to get the balance right. The club might want to offer women a break if they are in short supply (through a lower price or free drinks). Or it might want to ration the spots to ensure the appropriate number of women; popular clubs typically have queues waiting outside, and women are picked out of line disproportionately.

The dating club example motivates the informal definition of a two-sided platform that we introduced in the beginning paragraph. There are two groups of customers—men and women. Members of each group value members interacting with members of the other group. And the platform provides a place for them to get together and interact. By doing so it enables members of these two groups to capture various benefits from having access to each other (and to many of each other).

Rochet and Tirole (2006) have proposed a formal definition:

> A market[5] is two-sided if the platform can affect the volume of transactions by charging more to one side of the market and reducing the price paid by the other side by an equal amount; in other words, the price structure matters, and platforms must design it so as to bring both sides on board.[6]

To satisfy this definition, "the relationship between end-users must be fraught with residual externalities" that customers cannot sort out for themselves.[7] That is clear in the case of the dating environment. In contrast, in the textbook wheat market there are no externalities connecting buyers

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[5] Note that the word market below is being used in the loose manner that is the custom among economists and not in the antitrust sense. The Rochet-Tirole definition would be more precise if it said "A two-sided platform business exists if ....."

[6] Jean-Charles Rochet & Jean Tirole, *Two-Sided Markets: A Progress Report*, RAND J. OF ECON. (forthcoming 2006).

[7] As a result a necessary condition for a market to be two-sided is that the Coase theorem does not apply to the transaction between the two sides. See Rochet and Tirole, *supra* note 6, for more details.

and sellers, and the price structure doesn't matter: a tax on wheat levied on buyers has the same effect on quantity as the same tax levied on sellers.

In addition, it must not be possible for the two sides to arbitrage their way around the price structure chosen by the platform. Men and women, for example, want to be able to search for dates among a large number of opposites. It is hard to conceive of a practical mechanism for women to reward men who come to a singles club but who they reject. Likewise, for the other two-sided platform industries we consider it is difficult, if not impossible, for customers on one side to make side payments to customers on the other side. As a result the platform owner can institute a pricing structure to harness indirect network effects, and it is not feasible for customers to defeat this pricing structure through arbitrage. Generally, one can think of two-sided platforms as arising in situations in which there are externalities and in which transactions costs, broadly considered, prevent the two sides from solving this externality directly. The platform can be thought of as providing a technology for solving the externality in a way that minimizes transactions costs.

It is helpful to review four different types of two-sided platforms: exchanges, advertiser-supported media, transaction devices, and software platforms.[8]

2.1.   Exchanges

Exchanges have two groups of customers, who can generally be considered "buyers" and "sellers." The exchange helps buyers and sellers search for feasible contracts—that is where the buyer and seller could enter into a mutually advantageous trade—and for the best prices—that is where the buyer is paying as little as possible and the seller receiving as much as possible. (In organized exchanges, such as the New York Stock Exchange, it is often more useful to think of the two sides as liquidity providers—specialists or market-makers who quote prices to both buyers and sellers and thus bring liquidity to the market—and liquidity consumers—ordinary customers who accept liquidity providers' offers.[9]) We use the term buyers and sellers here loosely. The term,

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[8] For discussion, see DAVID S. EVANS, ANDREI HAGIU, AND RICHARD SCHMALENSEE, INVISIBLE ENGINES: HOW SOFTWARE PLATFORMS DRIVE INNOVATION AND TRANSFORM INDUSTRIES, Ch. 3 (MIT Press 2006). We refer there to software platforms more generally as shared input facilities. Armstrong uses the term "competitive bottlenecks" to refer to certain shared-input facilities. Although his discussion is analytically sound, his term is pejorative and has a meaning in competition law that differs from the one he assigns to it. *See* MARK ARMSTRONG, COMPETITION IN TWO-SIDED MARKETS (EconWPA, Working Paper 2005).

[9] Bernhard Friess & Sean Greenaway, *Competition in EU Trading and Post-Trading Service Markets*, 2 Competition Policy International (2006).

"exchanges," covers various matchmaking activities such as dating services and employment agencies. It also covers traditional exchanges such as auction houses, internet sites for business-to-business, person-to-business, and person-to-person transactions, various kinds of brokers (insurance and real estate) and financial exchanges for securities and futures contracts. Finally, exchanges include a variety of businesses that provide brokerage services. These include publishers (readers and authors), literary agents (authors and publishers), travel services (travelers and travel-related businesses), and ticket services (people who go to events, and people who sponsor events).

Exchanges provide participants with the ability to search over participants on the other side and the opportunity to consummate matches. Having large numbers of participants on both sides increases the probability that participants will find a match. Depending on the type of exchange, however, a larger number of participants can lead to congestion. That is the case with physical platforms such as singles clubs or trading floors. Moreover, participants may derive some value from having the exchange prescreen participants to increase the likelihood and quality of matches.

Some exchanges charge only one side. For example, only sellers pay directly for the services provided by eBay. This is also true for real-estate sales in the United States. Other exchanges charge both sides, although the prices may bear little relation to side-specific marginal costs. Internet matchmaking services charge everyone the same, for instance, while, as we mentioned, physical dating environments sometimes charge men more than women. Auction houses charge commissions to buyers and sellers. Insurance brokers historically charged both insurance customers and insurance providers in some types of transactions (some have agreed not to as a result of settlements of lawsuits brought by the New York State Attorney General).

2.2.   Advertising-Supported Media

Advertising-supported media such as magazines, newspapers, free television, and web portals are based on a two-sided business model. The platform either creates content (newspapers) or buys content from others (free television). The content is used to attract viewers. The viewers are then used to attract advertisers. There is a clear indirect network effect between advertisers and viewers—advertisers value platforms that have more viewers; the extent to which viewers value

advertisers is the subject of more debate but we suspect that viewers value advertisers more than they might admit.[10]

Most advertising-supported media earn much of their revenues—and probably all of their gross margin—from advertisers.[11] Print media are often provided to readers at something close to or below the marginal cost of printing and distribution.[12] In some cases—such as yellow page directories and some newspapers—they are provided for free. Free television is just that. And most web portals—Google and Yahoo for example—receive revenue only from advertisers.

2.3.   Transaction Systems

Any method for payment works only if buyers and sellers are willing to use it. Humans switched from barter when they were agreed on a standard metric for exchange—such as metallic coins or seashells. Governments facilitated this by ensuring the integrity of coins (to various degrees) and by using government-issued coinage for buying and selling. Cash, which has no intrinsic value in most modern economies, provides a payment platform because buyers and sellers expect that other buyers and sellers will use it. Of course the government facilitates this with various laws and through its own buying and selling activities.

For-profit transaction systems are based on the same principles although they have challenges that governments—which at least in principle can create a platform by fiat—do not necessarily have. Although bank checks and travelers' checks are also examples of for-profit

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[10] See, e.g., James M. Ferguson, *Daily Newspaper Advertising Rates, Local Media Cross-Ownership, Newspaper Chains, and Media Competition*, 26 J. OF L. & ECON. 637 (1983), ("Readership studies show that advertising, especially retail advertising, is considered as important as, or more important than, editorial content.") and R.D. Blair & R.E. Romano, *Pricing Decisions of the Newspaper Monopolist*, 59 SOUTHERN ECON. J. 731 (1993), ("circulation demand rises with increases in the quantity of advertising"). Other studies have shown that, unlike Americans, readers in certain European countries are averse to advertising. See, e.g., Nathalie Sonnac, *Readers' Attitudes Toward Press Advertising: Are They Ad-Lovers or Ad-Averse?*, 13 J. OF MEDIA ECON. 249 (2000). On the other hand, TiVo and other related products that permit ad avoidance and deletion are very popular currently, with one study citing that TiVo viewers skip about 60 percent of commercials. See *A Farewell to Ads?*, ECONOMIST, Apr. 15, 2004.

[11] In a two-sided platform there is no rigorous way to define the profit "earned" by one side or the other. Not only are there typically costs that are common to both sides (the floor of the New York Stock Exchange, for instance), outlays that build business on one side of the market (via product enhancement, say) will also tend, via the externality, to build business on the other side. By "gross margin" we mean the difference between revenue and the variable costs, if any, that depend entirely on the volume on only one side of the market. The cleanest examples of such a cost would be the manufacturing costs of video game consoles or the marginal printing costs of newspapers or yellow page directories.

[12] Blair & Romano, *supra* note 10.

transaction systems, we focus on payment cards, which have been the subject of significant competition policy scrutiny in many countries.

Diners Club started the first two-sided payment system in 1950. Before then stores issued payment cards to their customers for use only at their stores. Diners Club began by getting a set of restaurants to agree to take its card for payment; that is to agree to let Diners Club reimburse the restaurant for the meal tab and then in turn collect the money from the cardholder. It also persuaded individuals to take its card and use it for payment. Starting with a small base in Manhattan it grew quickly throughout the United States and other countries.

Diners Club charged restaurants seven percent of the meal tab; cardholders had to pay an annual fee, which was offset in part by the float they received as a result of having to pay their bills only once a month. As a result Diners Club earned most of its revenue—and most likely all of its gross margin—from merchants. Other entrants into the charge and debit card businesses have followed this same approach. Determining who pays in the case of credit cards is a bit more complicated since that product bundles a transaction feature (for which the cardholder pays little) and a borrowing feature (for which the cardholder incurs finance charges). However, it is safe to say that merchants are the main source of revenue for credit cards held by people who do not revolve balances.

American Express, Discover, and, until its recent absorption into MasterCard, Diners Club, set prices to merchants—the merchant discount, which gives rise to a positive variable transaction price—and to cardholders—annual fees and various rewards which may give rise to negative variable transaction prices. Card associations such as MasterCard and Visa are examples of cooperative two-sided platforms. For a transaction to be consummated there has to be an agreement on the division of profits and the allocation of various risks between the entity that services the merchant and the entity that services the cardholder. Most card associations set this centrally as, in effect, a standard contract between the businesses that service the two sides. Typically, they agree that the entity that services the merchant pays a percentage of the transaction—the "interchange fee"—to the entity that services the cardholder. This fee ultimately determines the relative prices for cardholders (issuers obtain a revenue stream which they compete for) and merchants (acquirers pass the cost of the

interchange fee onto merchants). This centrally set fee has been the subject of litigation and regulatory scrutiny, as we discuss below.[13]

2.4.   Software Platforms

A software platform provides services for applications developers; among other things, these services help developers obtain access to the hardware for the computing device in question. Users can run these applications only if they have the same software platform as that relied on by the developers; developers can sell their applications only to users that have the same software platform they have relied on in writing their applications.

Software platforms are central to several important industries. These include personal computers (e.g., Apple, Microsoft); personal digital assistants (e.g., Palm, Treo); 2.5G+ mobile telephones (e.g., Vodafone, DoCoMo); video games (e.g. Sony PlayStation, Xbox); and digital music devices (e.g., Creative Zen Micro, Rio Carbon). With the exception of video games, the software platform owners make most of their revenue, and all of their gross margin, from the user side; developers generally get access to platform services for free, and they obtain various software products that facilitate writing applications at relatively low prices. Video game console manufacturers, on the other hand, typically receive virtually all of their gross margin from licensing access to the software and hardware platforms to game developers; they sell the video game console at close to or below manufacturing cost.

Software platforms facilitate a market for applications by reducing duplicative costs. Application programs need to accomplish many similar tasks. Rather than each application developer writing the code for accomplishing each task the software platform producer incorporates code into the platform. The functions of that code are made available to application developers through an application program interface (API). The user benefits from this consolidation as well since it reduces the overall amount of code required on the computer, reduces incompatibilities between programs, and reduces learning costs.[14] An important consequence of this reduction in cost

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[13] DAVID S. EVANS & RICHARD SCHMALENSEE, THE ECONOMICS OF INTERCHANGE FEES AND THEIR REGULATION: AN OVERVIEW (MIT Sloan Working Paper, 2005b), in *Interchange Fees in Credit and Debit Card Industries*, Kansas City: Federal Reserve Bank of Kansas City, 2005, pp. 73-120.

[14] See Evans, Hagiu, & Schmalensee, *supra* note 8.

is an increase in the supply of applications for the platform, an increase in the value of the software platform to end users, and positive feedback effects to application developers.

2.5. Methods for Minimizing Transactions Costs

The fundamental role of a two-sided platform in the economy is to enable parties to realize gains from trade or other interactions by reducing the transactions costs of finding each other and interacting. Two-sided platforms do this by matchmaking, building audiences, and minimizing costs. Different platforms engage in these activities to different degrees. Software platforms are mainly about minimizing duplication costs, advertising-supported media in mainly about building audiences, and exchanges are mainly about matchmaking. But they all seem to engage in each to some degree. All platforms help reduce costs by providing a virtual or physical meeting place for customers. We will see that these platforms all minimize transactions costs by through matchmaking, audience-making, and cost minimization through the elimination of duplication.[15]

MySpace.Com provides an example of how a two-sided platform engages in all three functions. It is a popular internet site where young people can post their profiles and develop networks of friends. It provides matchmaking between the people who sign up as well as the advertisers who would like to meet them. It builds audiences for advertisers as well as members—particularly musicians—who want to make themselves known. And it reduces the costs to people of getting together by providing a common meeting place.

3.   Economic Principles

The theoretical economics literature on two-sided platforms is relatively new. Economists have derived many results based on stylized models that apply to some of the industries described above. The precise results are sensitive to assumptions about the economic relationships among the various industry participants. Even for these special cases it has turned out to be challenging to derive results without making further assumptions about the precise nature of the demand, cost, and indirect network effects relationships.[16] Nevertheless, several principles have emerged that seem to be robust. They appear to depend only on the assumptions that the platform has two groups of

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[15] See DAVID S. EVANS & RICHARD SCHMALENSEE, CATALYST CODE: THE STRATEGIES BEHIND THE WORLD'S MOST SUCCESSFUL COMPANIES (Harvard Business School Press 2007).

[16] That is, the models are based on assuming particular functional forms—e.g. linear—for relationships.

customers, that there are indirect network externalities, and that the customers cannot solve these externalities themselves.

3.1. Pricing

To see the intuition behind pricing consider a platform that serves two customer groups A and B. It has already established prices to both groups and is considering changing them.[17] If it raises the price to members of group A fewer As will join. If nothing else changed the relationship between price and the number of As would depend on the price elasticity of demand for As. Since members of group B value the platform more if there are more As fewer Bs will join the platform at the current price for Bs. That drop-off depends on the indirect network externality which is measured by the value that Bs place on As. But with fewer Bs on the platform, As also value the platform less leading to a further drop in their demand. There is a feedback loop between the two sides. Once this effect is taken into account, the effect of an increase in price on one side is a decrease in demand on the first side because of the direct effect of the price elasticity of demand and on both sides as a result of the indirect effects from the externalities.

A few equations will make this point more sharply for readers familiar with the concept of elasticity. The situation described just above can be summarized by two demand functions: $Q^A = D^A(P^A, Q^B)$ and $Q^B = D^B(P^B, Q^A)$. The first of these gives participation by members of group A as a function of the price charged to group A and participation by group B, and the second gives participation by members of B similarly. Let $e^I = -(\partial D^I / \partial P^I)(P^I / Q^I)$, for $I=A,B$. These are the own-price elasticities for each group, holding constant *participation* by the other—i.e., ignoring the externalities linking the two groups. Let $\theta_J^I = (\partial D^I / \partial Q^J)(Q^J / Q^I)$ for $I,J=A,B$, $I \neq J$. These elasticities measure the strengths of the externalities connecting the two groups. In the normal two-sided case, both would be expected to be positive. Finally, let $E^I = -(dQ^I / dP^I)(P^I / Q^I)$ for $I=A,B$. These are the ordinary own-price elasticities, computed assuming other prices remain constant but allowing participations (quantities) to vary. Differentiating both demand functions totally with respect to either price, and solving, yields:

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[17] To keep matters simple we consider the case where each side is charged a membership fee as in Armstrong (2005). More generally, platforms are natural businesses for two-part tariffs involving an access fee and a usage fee.

$$E^I = e^I /(1 - \theta_J^I \theta_I^J); I, J = A, B; I \neq J.$$

Even if the *As* are not particularly price-sensitive, and as long as the externalities between the groups are strong (in either direction!), participation by group *A* may be highly sensitive to the price its members are charged, and similarly for group *B*. Even a small response by group *A* to a price change will trigger a response by group *B*, which in turn will produce a response by *A*, and so on. (The equation above assumes that these response sequences converge.)

The platform of course would like to find the prices that maximize its profits by taking these same sorts of considerations into account. For a single-sided business that would occur by selecting the output at which marginal revenue equals marginal cost and then charging the corresponding price for this quantity from the demand curve. (This equilibrium is often described by the standard Lerner formula that says that the price-cost margin equals the inverse of the own-price elasticity of demand.) For two-sided platforms three results appear to be robust:

1) The optimal prices depend in a complex way on the price sensitivity of demand on both sides, the nature and intensity of the indirect network effects between the two sides, and the marginal costs that result from changing output of each side.

2) The profit-maximizing, non-predatory price for either side may be below the marginal cost of supply for that side or even negative.

3) The relationship between price and cost is complex, and the simple formulas that have been derived for single-sided markets do not apply.

For many platforms it is possible to charge two different kinds of prices: an access fee for joining the platform and a usage fee for using the platform. Although these are interdependent, one can think of the access fee as mainly affecting how many customers join the platform and the usage fee as mainly affecting the volume of interactions between members of the platform. Most software platforms charge access fees to users—they have to license the software platform but then can use it as much as they want—and do not charge access or usage fees to developers. Videogame console vendors, though, charge a usage fee to game developers—a royalty based on the numbers of games that are sold; users pay this usage fee indirectly through their purchase of games for the console. Payment card systems generally charge merchants a usage fee but no access fee. Cardholders may pay an access fee (the annual card fee); they often pay either no usage fee or a negative one (to the extent they receive rewards based on transactions volume).

The profit-maximizing reliance on access versus usage fees depends on many factors including the difficulty of monitoring usage and the nature of the externality between the two sides. Cardholders care about card acceptance, for instance, while merchants care about usage. It thus seems sensible not to charge merchants for access and not to charge consumers for usage.

The empirical evidence suggests that prices that are at or below marginal cost are common for two-sided platforms. Table 1 summarizes some relevant evidence.

Table 1. Examples of Two-Sided Pricing Structures[18]

Industry	Side	Access	Usage
Heterosexual Dating Clubs	Men	√	√
	Women	√	√
DoCoMo i-Mode	User	√	√
	Content-Provider	Ø	√
U.S. Real Estate Brokers	Seller	Ø	√
	Buyer	Ø	Ø
Magazines	Reader	√ (≤MC)	Ø
	Advertiser	Ø	√
Shopping Malls	Shopper	–	Ø
	Store	√	Ø
PC Operating Systems	User	√	Ø
	Developer	√ (<MC)	Ø
Video Game Consoles	Player	√ (≤MC)	Ø
	Game Developer	√ (<MC)	√
Payment Card Systems	Merchant	Ø	√
	Cardholder	√ (<MC)	Ø

Note: √ and Ø indicate that the entity either pays or does not pay, respectively, for either access or usage of the two-sided platform. Items in parentheses indicate where marginal cost or below marginal cost pricing is prevalent for a particular side of a two-sided platform.

3.2.   Design Decisions

Two-sided platforms are in the business of encouraging customers to join their platforms and stimulating them to interact with each other once they have joined. They design their platforms with this in mind. This can lead to decisions that in a narrow sense harm one side.

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[18] This table shows pricing structures that are common in these industries. In many cases, fees will differ from these pricing structures. For example, some clubs offer free entry to women, some magazines offer free subscriptions, some video game players pay fees for on-line play, and some payment cardholders do not pay fees for their cards and/or get usage based rewards. For dating clubs, usage fees for men and women refer to fees for drinks in the club. For real estate, the usage fee for sellers refers to the fee for selling a house; there is typically no fee for using the system to list or show a house. For shopping malls, the negative usage fee for shoppers refers to the free parking that is commonly available. For video game consoles, players do not pay a fee for using the console, although they do pay for video games to the game developer (which in some cases is the same firm that makes the console and in other cases pays a royalty to the console manufacturer). For payment cards, cardholders are also subject to penalty fees, such as for exceeding credit limits or for late payments; we have not included these fees in the table.

A simple example is a shopping mall. Shoppers would prefer to get to stores in the least amount of time. Merchants would like to maximize the amount of foot traffic outside their stores and therefore the number of potential shoppers. Shopping malls are sometimes designed to encourage shoppers to pass by many stores—e.g. by putting the up and down escalators at different ends of the mall.

Advertising-supported media are another obvious example. Viewers would like to gain access to the content—and perhaps even the advertisements of their choice—in the most convenient way. Some magazines are laid out to make it difficult even to find the table of contents or to find the continuation of an article without thumbing through many advertisements. Television watchers might benefit from having advertisements clustered at the beginning or the end of each program, but television providers (in the United States, at least) typically intersperse the advertisements and precede them perhaps with a cliffhanger to discourage viewers from taking a long break.

Two-sided platforms may also bundle features that directly benefit side *A* but harm side *B* (putting aside the indirect externalities from increasing the participation of side *A*).[19] All software platforms include features for example that do not benefit most users. However, some developers value each of these features and in particular value knowing that any user of the software will have that feature and therefore be able to run its applications. All payment card systems require merchants that take their cards for payment to take any of their cards for payment, regardless of who presents it or which entity issued it. Some merchants would benefit from being selective—taking cards only from people who lack cash, for example. But this would reduce the confidence that cardholders have that their cards will be taken at stores that display the acceptance mark. (We will see later that special cases of these requirements, linking acceptances of credit and debit cards, have given rise to tying claims. This paragraph is not meant to suggest that tying could not be used in an anticompetitive way by two-sided platforms but rather to point out that there is an additional efficiency explanation for at least one aspect of this practice that does not arise in one-sided businesses.)

3.3. Rules and Regulations

Given that platforms promote interactions between customers and seek to harness indirect network externalities it should come as no surprise that two-sided platforms have an incentive to

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[19] See Rochet and Tirole, *supra* note 6.

devise rules and regulations that promote these externalities and limit negative externalities between customers. The most sophisticated rules and regulations may be those employed by exchanges. All exchanges have rules against "front-running," for instance. This practice occurs when a broker receives a large purchase order from a customer, first buys on his own account, and then executes the customer order, which drives the price up slightly, and then sells on his own account and pockets the resulting profit. Banning this practice directly harms brokers, but it makes buyers and sellers more confident that they are getting the best price possible, and thereby boosts volume on the exchange.

Cooperative two-sided platforms have further need for rules and regulations because the behavior of their members can affect the value of the two-sided platform as a whole. Visa, for example, has rules that govern the appearance of cards issued by members, to provide some uniformity for the common brand, as well as to prevent members from using the brand inappropriately. The system also has rules that address disputed transactions. Acquirers would have an incentive to favor their customers (merchants) in a dispute while issuers would favor their customers (cardholders). The system's rules attempt to find a balance between these competing interests, to increase the attractiveness of the system as a whole.

4. Industrial Organization of Markets with Two-Sided Platforms

Casual empiricism shows that industries with two-sided platforms are quite diverse. We explain some of the basic determinants of this heterogeneity from a theoretical perspective and then document aspects of it by surveying industries in which two-sided platforms are central.

4.1. Determinants of Platform Size and Structure

Five fundamental factors determine the relative size of competing two-sided platforms. Table 2 summarizes the factors we discuss below and their effect on size (with a "+" indicating that there is a positive association between size and the factor).

Table 2. Determinants of Industry Structure

Cause	Effect on Size/Concentration
Indirect network effects	+
Scale economies	+
Congestion	-
Platform differentiation	-
Multi-homing	-

Indirect Network Effects

Indirect network effects between the two sides promote larger and fewer competing two-sided platforms. Platforms with more customers of each group are more valuable to the other group. For example, more users make software platforms more valuable to developers and more developers make software platforms more valuable to users. These positive-feedback effects make platforms with more customers on both sides more valuable to both sets of customers. To take another example, a payment card system whose cards are taken at more merchants is more valuable to card users—that is why we see card systems touting their acceptance ("MasterCard: No card is more accepted.") in consumer advertisements.

If there were no countervailing factors, we would expect that indirect network effects would lead two-sided platforms to compete *for* the market. First movers would have an advantage, all else being equal. We would have the familiar story that the firm that obtains a lead tends to widen that lead as a result of positive-feedback effects and therefore wins the race for the market.[20] Other firms could compete with this advantage only if they offered consumers on either side something that offset the first mover's size advantage.

Indirect network effects may decline with the size of the platform. For example, the probability of finding a match increases at a diminishing rate with the number of individuals on either

[20] See, e.g., David S. Evans & Richard Schmalensee, *A Guide to the Antitrust Economics of Networks*, 10 ANTITRUST MAGAZINE 36 (1996) and CARL SHAPIRO & HAL R. VARIAN, INFORMATION RULES: A STRATEGIC GUIDE TO THE NETWORK ECONOMY (Harvard Business School Press 1999).

side (buyers or sellers, men or women).[21] At some point positive externalities from more participants may turn into negative externalities in the form of congestion as discussed below.

Economies and Diseconomies of Scale

For many two-sided platforms there would appear to be significant fixed costs of providing the platform. This should lead to scale economies over some range of output. For example, card payment systems have to maintain networks for authorizing and settling transactions for cardholders and merchants (and for their proxies—issuers and acquirers—in the case of association-based payment systems such as MasterCard). The costs of developing, establishing, and maintaining these networks are somewhat independent of volume. To take another example, there is a fixed cost of developing a software platform but a low marginal cost of providing that platform to developers and end users. In some cases the scale economies may mainly operate on one side. For example, there are scale economies in providing newspapers to readers (there is a high fixed cost of creating the newspaper and a relatively low marginal cost of reproducing and distributing it) but not in providing space to advertisers. Lastly, some physical platforms such as trading floors and singles clubs have scale economies at least in the short run, up to their capacity levels.

Diseconomies may set in at some point for various reasons on one or both sides. For example, to persuade existing end users to replace (i.e. upgrade) their existing software platforms software, platform vendors have to add features and functionality. Many of these improvements may be designed to encourage application developers to write new or improved applications for the platform that in turn benefit end users. However, as software platforms have gotten larger and more complex, it has become more expensive and time consuming to add features and functionality. The most recent version of the Apple OS took four months longer to develop than the previous version.[22] Microsoft's Vista operating system has also been plagued with very long delays.

Congestion and Search Optimization

Several design issues tend to limit the size of two-sided platforms. Physical platforms such as trading floors, singles clubs, auction houses, and shopping malls help customers search for and

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[21] See Evans, *supra* note 1.

[22] For Apple OS release dates, see Jason Snell, *Jaguar unleashed: Mac OS X 10.2 Arrives*, Macworld, Sept. 1, 2002; Sarah Stokely, *Apple Sets Panther Release Date*, IDG DATA, Oct. 10, 2003.; and Steven Musil, *This Week in Tiger: Apple releases Mac OS X 10.4*, CNET NEWS, Apr. 29, 2005.

consummate mutually advantageous exchanges. At a given size expanding the number of customers on the platform can result in congestion that increases search and transaction costs.[23] It may be possible to reduce congestion by increasing the size of the physical platform, but that in turn may increase search costs. Indeed, to optimize searching for partners, two-sided platforms may find that it is best to limit the size of the platform and prescreen the customers on both sides to increase the probability of a match. One might argue that singles-type clubs do this explicitly (deciding who can get into an "exclusive" club) or implicitly (compare church-oriented singles groups and Club Med resorts). We will return to this subject below in discussing platform differentiation. Congestion may arise on one side alone. For example, increasing the volume of advertising in a newspaper may not only crowd out the content that attracts the readers but also result in a cacophony of messages that reduces the effectiveness of any particular advertisement.

Platform Differentiation and Multi-homing

Platforms can differentiate themselves from each other by choosing particular levels of quality (what is known as "vertical differentiation") with consumers choosing the higher or lower quality of platform depending on the income and relative demand for quality. There are, for example, upscale and downscale malls. Platforms can also differentiate themselves from each other by choosing particular features and prices that appeal to particular groups of customers (what is known as "horizontal differentiation"). Thus there are numerous advertising-supported magazines that appeal to particular segments of readers and advertisers (e.g. *Cape Cod Bride* or *Fly Fisherman*).

Horizontal differentiation can result in customers choosing to join and use several platforms—a phenomenon that Rochet and Tirole have called "multi-homing". Customers find certain features of different competing platforms attractive and therefore rely on several. Payment cards are an example of multi-homing on both sides. Most merchants accept credit and debit cards from several systems, including ones that have relatively small shares of cardholders. Many cardholders carry multiple cards, although they may tend to use a favorite one most often.[24] Advertising-supported media also have multi-homing on both sides—advertisers and viewers rely on

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[23] For a general discussion on matching, search, and congestion see, for example, Robert Shimer & Lones Smith, *Matching, Search, and Heterogeneity*, 1 ADVANCES IN MACROECONOMICS (2001) and Mark Rysman, *Competition Between Networks: A Study of the Market for Yellow Pages*, 71 REV. OF ECON. STUDIES 483 (2004b).

[24] MARK RYSMAN, AN EMPIRICAL ANALYSIS OF PAYMENT CARD USAGE (Boston University - Department of Economics, Working Paper, 2004a).

many differentiated platforms. Other two-sided platforms have multi-homing only on one side. Most end-users rely on a single software platform for their personal computers, for instance, while many developers write for several platforms.

4.2. *Empirical Evidence on Two-sided Industry Structure*

It is possible to see some regularities across industries in which two-sided platforms appear to be the dominant form of organization. Table 1 above and Table 3 reveal several features:

- It is relatively uncommon for industries based on two-sided platforms to be monopolies or near monopolies. Some industries based on two-sided platforms have several large differentiated platforms, while others have many small platforms that are differentiated by location as well as along other dimensions.

- Multi-homing on at least one side is common. Horizontal product differentiation tends to be the norm.

- Asymmetric pricing is relatively common. Many two-sided platforms appear to obtain the preponderance of their operating profits (revenues minus direct costs) from one side. A nontrivial portion of two-sided platforms appear to charge prices that are below marginal cost or below zero.

Table 3. Presence of Multi-homing and Largest Competitor Share of Selected Two-Sided Platforms

Multi-Sided Platform	Sides	Presence of Multi-homing	Largest Competitor Share in the United States
Residential Property Brokerage	Buyer Seller	*Uncommon:* Multi-homing may be unnecessary, since a multiple listing service allows the listed property to be seen by all member agencies' customers and agents.	Fifty largest firms have a 23% share. (2002)
Securities Brokerage	Buyer Seller	*Common:* The average securities brokerage client has accounts at three firms. Note that clients can be either buyers or sellers or both.	Four largest firms accounted for 37% of in securities brokerage and 16% in financial portfolio management. (2002)
Newspapers and Magazines	Reader Advertiser	*Common:* In 1996, the average number of magazine issues read per person per month was 12.3. *Also common for advertisers:* for example, AT&T Wireless advertised in the New York Times, The Wall Street Journal, and Chicago Tribune, among many other newspapers, on Aug. 26, 2003.	Wall Street Journal had a 28% share of the five largest newspapers. (2001)
Network Television	Viewer Advertiser	*Common:* For example, viewers in Boston, Chicago, Los Angeles, and Houston, among other major metropolitan areas, have access to at least four main network television channels: ABC, CBS, FOX, and NBC. *Also common for advertisers:* for example, Sprint places television advertisements on ABC, CBS, FOX, and NBC.	U.S. law forbids broadcasters from owning TV stations reaching more than 35% of the nation's television audience.
Operating System	End User Application Developer	*Uncommon for users:* Individuals typically use only one operating system. *Common for developers:* As noted earlier, the number of developers that develop for various operating systems indicates that developers engage in significant multi-homing.	Microsoft has a 96% share of revenue of client operating systems. (2004)
Video Game Console	Game Player Game Developer	*Varies for players:* The average household (that owns at least one console) owns 1.4 consoles. *Common for developers:* For example, in 2003, Electronic Arts, a game developer, developed for the Nintendo, Microsoft, and Sony platforms.	Sony PS1 and PS2 had a 63% share of console shipments in North America. (2003)
Payment Card	Cardholder Merchant	*Common:* Most American Express cardholders also carry at least one Visa or MasterCard. In addition, American Express cardholders can use Visa and MasterCard at almost all places that take American Express.	The Visa system had a 45% share of all credit, charge, and debit purchase volume. (2004)

Source: Adapted from David S. Evans, *The Antitrust Economics of Multi-Sided Platform Markets*, 20 YALE J. ON REG. 325 (2003a). Industry share data from United States Census Bureau, 2002 Economic Census <http://www.census.gov/econ/census02/guide/INDSUMM.HTM>; "Top 20 U.S. Daily Newspapers by Circulation," Newspaper Association of America <http://www.naa.org/info/facts01/18_top20circ/index.html>; Stephen Labaton, "U.S. Backs Off Rules for Big Media," *New York Times*, January 28, 2005; Al Gillen and Dan Kusnetzky, "Worldwide Client and Server Operating Environments 2004-2008 Forecast," *IDC Market Analysis*, No. 32452, December 2004; Schelley Olhava, "Worldwide Videogame Hardware and Software 2004-2008 Forecast and Analysis," *IDC Market Analysis*, No. 31260, May 2004; *The Nilson Report*, No. 828, February 2005; *The Nilson Report*, No. 833, May 2005.

5.   Overview of Antitrust Cases Involving 2-Sided Markets

Many antitrust cases have involved two-sided platforms. A few—including several important ones—seem to have touched on two-sided issues before economists began to address them formally. And some are based on analyses of markets and practices that, putting aside whether they led to the correct verdict or not, are analytically wrong from the perspective of the two-sided literature.

Table 4. Summary of Leading Cases by Two-Sided Platform Type[25]

	Case	Case Type		Case	Case Type
Media	Times Picayune	Monopolization	**Transaction Systems**	NaBanco	Cartel
	Magill	Refusal to supply		Wal-Mart	Tying
	BT Yellow Pages	Monopolization			
	Lorain Journal	Exclusive dealing			
Exchanges	Sotheby's-Christies	Cartel	**Software Platforms**	Microsoft-Browser	Monopolization, Tying
	Marsh McLennan	Cartel		Microsoft-Media Player	Tying
	Stock Exchanges	Merger		Nintendo	Exclusivity
	Mobile operators	Excessive Pricing			

Table 4 presents an overview of antitrust cases in the European Community and the United States that concern two-sided platforms. We have not done a systematic review of cases but have rather listed cases that have had a high profile in these jurisdictions with which we are generally familiar.[26] The cases span all of the major categories of two-sided platforms and involve the spectrum

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[25] United States v. Times-Picayune Publishing Co., 345 U.S. 594 (1953); RTE, BBC, and ITP v. Commission of the European Communities, ("Magill") Joined Cases C-241/91 P and C-242/91 P-, ECR 1995 I-00743 (Apr. 6, 1995); UK Competition Commission, *Classified Directory Advertising Services* (March 1996); UK Office of Fair Trading, *Classified Directory Advertising Services: Review of Undertakings Given by BT to the Secretary of State in July 1996* (May 2001); United States v. Lorain Journal Co., 342 US 143 (1951); United States v. Taubman, 297 F.3d 161 (2d Cir. 2002); State of New York v. Marsh & McLennan Companies, Inc., et al., Complaint filed October 14, 2004, Index No. 04-403342; Competition Commission, *A report on the proposed acquisition of London Stock Exchange plc by Deutsche Börse AG or Euronext NV* (November 2005); US Department of Justice, *Department of Justice Antitrust Division Statement on the Closing of its Two Stock Exchange Investigations* (Nov. 16, 2005); Office of Communications(Ofcom), *Wholesale Mobile Voice Call Termination* (June 1, 2004); National Bancard Corp. v. Visa U.S.A., Inc., 779 F.2d 592, 602 (11th Cir. 1986); In re Visa Check/MasterMoney Antitrust Litigation, 192 F.R.D. 68 (E.D.N.Y 2000); United States v. Microsoft 87 F. Supp. 2d 30 (D.D.C. 2000); Commission of the European Communities v. Microsoft, Case COMP/C-3/37.792/Microsoft; Atari Games Corp. v. Nintendo, 975 F.2d 832 (Fed. Cir. 1992).

[26] John Wotton, *Are Media Markets Analysed as Two-Sided Markets?* (2006) (unpublished manuscript, on file with the author).

of competition policy issues. This section summarizes some key issues that arose in several of these cases.

5.1. NaBanco

In *NaBanco v. Visa*, the federal district court and the Eleventh Circuit Court of Appeals recognized several of the key features of what have become known as two-sided platforms. Visa was (and is) a cooperative of banks that issued cards and acquired those card transactions from merchants. It established a rule for governing the situation in which an individual whose card was issued by bank A paid with that card at a merchant acquired by bank B, where A and B are different banks. Although those banks could have a bilateral agreement, Visa established a default rule that among other things determined the allocation of the profits and risks of the transaction. This rule provided that given the various allocations of risks and costs that the bank that acquired the transaction (B) had to pay the bank (A) that issued the card a percent of the transaction amount; this percent is known as the interchange fee, and it was initially set at 1.95 percent.

NaBanco argued that the interchange fee violated Section 1 of the Sherman Act because it was a price set collectively by competitors. Visa argued that unlike classic price fixing, the ability to set an interchange fee was a mechanism to allocate costs between the issuing and acquiring sides of the business and enhanced output by, among other things, limiting opportunistic behavior by individual members and avoiding the chaos of bilateral negotiations among thousands of member banks. The Eleventh Circuit concluded:

> Another justification for evaluating the [interchange fee] under the rule of reason is because it is a potentially efficiency creating agreement among members of a joint enterprise. There are two possible sources of revenue in the VISA system: the cardholders and the merchants. As a practical matter, the card-issuing and merchant-signing members have a mutually dependent relationship. If the revenue produced by the cardholders is insufficient to cover the card-issuers' costs, the service will be cut back or eliminated. The result would be a decline in card use and a concomitant reduction in merchant-signing banks' revenues. In short, the cardholder cannot use his card unless the merchant accepts it and the merchant cannot accept the card unless the cardholder uses one. Hence, the [interchange fee] accompanies "the coordination of other productive or distributive efforts of the parties" that is "capable of increasing the integration's efficiency and no broader than required for that purpose."[27]

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[27] National Bancard Corp. v. Visa U.S.A., Inc., 779 F.2d 592, 602 (11th Cir. 1986).

Professor William Baxter worked for Visa on this matter. His 1983 article in the *Journal of Law and Economics* presented many of the key concepts of two-sided markets within the context of the determination of interchange fees. The modern literature now recognizes that the interchange fee is at least partly a device for determining the pricing structure for the card system.[28] Some regulators and antitrust authorities, while recognizing the two-sided nature of the business, have argued in recent years that the interchange fee is set at a level that encourages the overuse of cards.

5.2. Stock Exchange Mergers

In recent years, stock exchanges have increasingly looked to merge with each other. In December 2004, Euronext and Deutsche Börse, respectively the second and third largest stock exchanges in Europe by value of trading, made bids to take over the London Stock Exchange, the largest stock exchange in Europe. Both bids were referred to the UK's Competition Commission for investigation under UK competition law—they did not qualify for investigation by the European Commission under EU law. In its report, the Competition Commission expressed concerns about the ownership of clearing services by the Euronext or Deutsche Börse that was likely to result post merger. It was believed that ownership of clearing services by the London Stock Exchange's parent company would act as a barrier to potential competitor exchanges to the London Stock Exchange that needed access to same clearing service to be competitive. Both Euronext and Deutsche Börse made commitments that satisfied the concerns of the Competition Commission but as a result of business rather than regulatory reasons, neither deal went through.

In the United States, in 2005 the New York Stock Exchange agreed to merge with Archipelago, an electronic stock exchange, and the NASDAQ Stock Exchange agreed to merge with Instinet, also an electronic stock exchange. The Justice Department approved both mergers, in part because it believed that there were no likely anticompetitive effects given the planned and likely entry of other firms. In 2006, the New York Stock Exchange and Euronext announced they had agreed to merge. As of this writing, the transaction is still pending antitrust and regulatory approval from authorities in the United States and Europe.

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[28] See, e.g., Richard Schmalensee, *Payment Systems and Interchange Fees*, 50 J. OF INDUSTRIAL ECON. 103 (2002); Jean-Charles Rochet & Jean Tirole, *Cooperation among Competitors: Some Economics of Credit Card Associations*, 33 RAND J. OF ECON. 549 (2002); See Rochet & Tirole, *supra* note 2; See Wright, *supra* note 1; DAVID S. EVANS & RICHARD SCHMALENSEE, PAYING WITH PLASTIC: THE DIGITAL REVOLUTION IN BUYING AND BORROWING (MIT Press 2005a); and David S. Evans & Richard Schmalensee, *supra* note 13.

Stock and other exchanges exhibit significant network effects. Fundamentally, more trading activity on the part of providers and consumers of liquidity tends to reduce spreads between bid and ask prices and to make markets more liquid, so that large blocks of stocks, options, or commodities can be bought or sold rapidly without a price penalty. And, of course, smaller bid-ask spreads and more liquidity tend to attract more trading. The more investors that come to a market, the more attractive that market becomes to liquidity providers, and the more liquidity providers are present, the more attractive the market is to investors. [29]

Traditionally, stock exchanges have tended to be local monopolies, due in large part to these network effects, to regulations that restricted cross-border trading and, historically in the U.S., to communications costs that created a niche for regional exchanges like the Boston Stock Exchange. As these restrictions have been relaxed and communications costs have fallen, competition has increased generally, and many exchanges have abandoned their traditional non-profit, cooperative structures and become for-profit firms. In the U.S., regional stock exchanges have had trouble competing with the NYSE, but competition between the NYSE and NASDAQ has intensified. There are now six competitive equity options exchanges in the U.S.; they are linked electronically so that investors are guaranteed the best available price, and the largest market shares hover below 40 percent. Stock exchanges have been ordered to provide such linkage; this is expected to happen some time in 2007 and may have a major effect on the competitive landscape.

In Europe, on the other hand, there has thus far been very little direct competition between the London Stock Exchange and other European exchanges, such as Euronext and Deutsche Börse. One key question in mergers between stock exchanges is whether network effects will continue to limit the scope for competition or whether falling communications costs and the computerization of the securities business will make global competition – of one sort or another – inevitable.

5.3. *Microsoft Media Player*

The European Commission found that Microsoft had abused a dominant position in operating systems by including media player technologies in Windows.[30] It argued that there were

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[29] See Friess & Greenaway, *supra* note 9.

[30] For contrary views on this case, see Maurits Dolmans & Thomas Graf, *Analysis of Tying Under Article 82 EC: The European Commission's Microsoft Decision in Perspective*, 27 WORLD COMPETITION 225 (2004). See also David S. Evans & A. Jorge Padilla, *Tying Under Article 82 EC and the Microsoft Decision: A Comment on Dolmans and Graf*, 27 WORLD COMPETITION 503 (2004).

indirect network effects between the use of media players and the provision of content. If more people have a particular media player, content providers will tend to encode content in that format. If more content is available in the format for a particular media player, users will tend to use that media player. The Commission argued that content providers would standardize on Windows Media Player because this player was available on most personal computers, which of course included Windows. In effect, the Commission argued that the existence of network effects would result in the "media player market" tipping to Windows Media Player.[31]

For its part Microsoft has agreed that there are indirect network effects but that the existence of such effects is not sufficient to tip a market to a single platform. In particular, it has argued that media players are horizontally differentiated products and that most content providers and many users engage in multi-homing. Who is right on this score depends on factual disputes between the Commission and Microsoft that we do not consider here.

5.4.   Magill

Magill is a leading European Community case involving the compulsory licensing of intellectual property. What makes it interesting from a two-sided standpoint is that it involved several interlinked two-sided platforms. The defendants in the case were three television networks (RTE, BBC, and ITV) whose broadcasts were received in Ireland. RTE and ITV were two-sided platforms, receiving revenues from advertisers. RTE was also supported by licenses paid by consumers for having television sets. The BBC received similar revenues from licenses for television sets in the UK (but not Ireland). The BBC did not allow advertising and was not a two-sided platform. All three networks published an advertising-supported television guide that contained their own weekly listings; these were two-sided platforms. In addition they each provided their daily listings to newspapers—other two-sided platforms—that combined the listings.

Magill TV Guide (Magill) wanted to publish a weekly advertising-supported guide that contained the listings of the three networks. The networks complained that this violated their copyrights. The Commission and ultimately the European courts concluded that there would be a market—in the antitrust sense—for a weekly television guide and that the refusal to supply the copyrighted information prevented the emergence of the weekly guide product. As it turns out, the

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[31] *Order of the President of the Court of First Instance. (Proceedings for Interim Relief—Article 82 EC)*, Case T-201/04 R 2, Microsoft Corporation v. Commission, Dec. 22, 2004, at ¶¶365, 388, *available at* http://curia.eu.int/en/content/juris/index_form.htm.

weekly newspapers were the main beneficiaries of this decision since they started weekly television supplements included in the Sunday newspapers. Magill never made a successful go of it.

We will return to these issues when we discuss the analysis of market definition and market power. The key point is that the analysis by all the parties (including the television networks) ignores a key side of the two-sided industry here—the advertisers who were the likely source of much of the revenue and profits—as well as the link between the guides and the television business.

6.   Antitrust Implications of Two-sided Platform Economics

Whether the economics of two-sided platforms can assist in determining whether a merger or business practice is anticompetitive is, like many aspects of economics, an empirical question. As with market power generally two-sidedness is a matter of degree. Sometimes the two-sided nature of the business is critical for the analysis. Other times it is an interesting aspect of the industry that should be thought about but is not ultimately determinative. And still other times an industry may have two-sided aspects that are too insubstantial to matter.

6.1.   Market Definition and Market Power

The analysis of market power, and the associated issue of the definition of the relevant market are typically a central component of antitrust cases, although the reasons for this vary somewhat across antitrust matters. In most cases it is crucial to determine whether the defendants have or could obtain significant market power and thus, by definition, maintain or raise prices above the competitive level. The determination of whether a firm or group of firms has market power can also be important because entities that have significant market power are more likely to have the ability and incentive to engage in business practices that could foreclose competition. Moreover, entities that obtain significant market power as a result of a business practice may be able to recoup costs they incur from investing in anticompetitive activities such as predatory pricing and vertical foreclosure. Business practices engaged in by entities that either lack market power or are unlikely to acquire it are often presumed benign (except of course for naked price fixing and related cartel practices).

The economics of two-sided platforms provides several insights into analysis of market power.

1) The link between the customers on the two-sides affects the price elasticity of demand and thus the extent to which a price increase on either side is profitable. It therefore necessarily limits market power all else equal. Consider two sides A and B. An increase in the price to side A reduces the number of customers on side A and therefore reduces the value that customers on side B receive from the platform. That in turn reduces the price that side B will pay and the number of customers on side B. The reduction in the number of customers on side B in turn reduces the demand on side A and thus the price that customers on side A will pay. These positive feedback effects may take some time to work themselves out, but, as we demonstrated above, even if, say, customers on side A are not very sensitive to price, *all else* (including the behavior of those in side B) *equal*, demand from side A may nonetheless end up being very price-sensitive indeed when these feedback effects work themselves out.

2) For two-sided platforms it can be important to recognize that competition on both sides of a transaction can limit profits. Suppose in a market without multi-homing that there is limited competition on side A because customers cannot easily switch between vendors of that side, but there is intense competition on side B because customers can and do switch between vendors based on price and quality. Then if competitors on side B cannot differentiate their products and otherwise compete on an equal footing, the ability to raise prices on side A will not lead to an increase in profits. Any additional profits on side A will be competed away on side B. This is different from a simple multi-product setting, since the platform cannot stop serving side B without leaving the business entirely. This point is especially relevant for assessing incentives and recoupment. It is also worth noting that the possibility of multi-homing on side B will permit positive profits, since it reduces the intensity of competition.

3) Price equals marginal cost (or average variable cost) on a particular side is not a relevant economic benchmark for two-sided platforms for evaluating either market power, claims of predatory pricing, or excessive pricing under European Community law. As we saw above, the non-predatory, profit-maximizing price on each side is a complex function of the elasticities of demand on both sides, indirect network effects, and marginal costs on both sides. Thus it is incorrect to conclude, as a matter of economics, that deviations between price and marginal cost on one side provide any indication of pricing to exploit market power or to drive out competition.[32]

The constraints on market power that result from interlinked demand also affect market definition. Market definition assists in understanding constraints on business behavior and assessing the contours of competition that are relevant for evaluating a practice. In some cases, the fact that a business can be thought of as two-sided may be irrelevant. That could happen either because the indirect network effects though present are small or because nothing in the analysis of the practices

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[32] For the two-sided platform as a whole, a formula similar to the standard Lerner index emerges in the Rochet-Tirole model. This is not a general result, and it thus suggests that the overall price-cost margin is somewhat less relevant than in single-sided businesses for evaluating overall market power.

really hinges on the linkages between the demands of participating groups. In other cases, the fact that a business is two-sided will prove important both by identifying the real dimensions of competition and focusing on sources of constraints.[33]

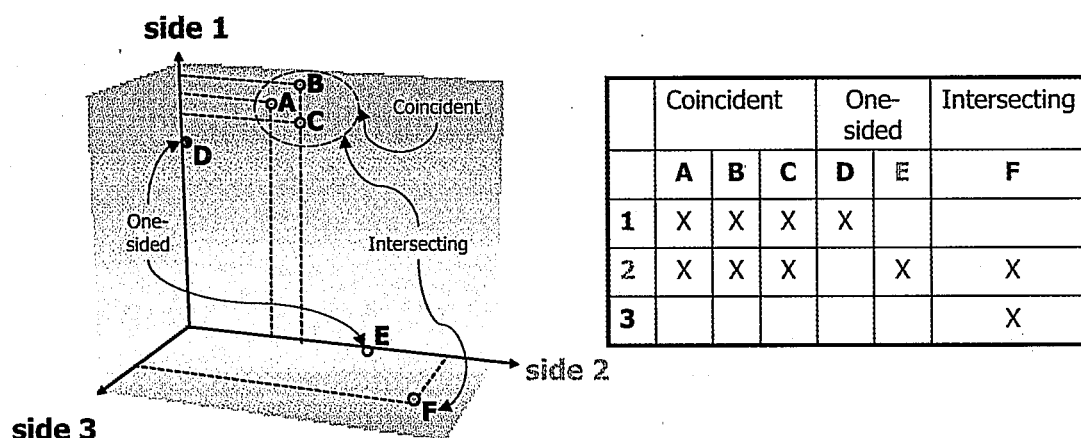|	Coincident			One-sided		Intersecting
	A	**B**	**C**	**D**	**E**	**F**
1	X	X	X	X		
2	X	X	X		X	X
3						X

Figure 1. Types of Differentiated Platform Competition

Figure 1 shows potential sources of competitive constraints for a two-sided platform denoted by *A.* It faces competition of some degree from other differentiated two-sided platforms that serve the same customer groups (e.g. the newspapers in a city). It also faces competition from single-sided businesses that provide competitive services to one side only (e.g. billboards). And it faces competition from other two-sided platforms that provide a product that competes mainly with one side but not the other (e.g., advertising-supported television). Again, the existence of these constraints does not mean they are important, only that they need to be looked at.

6.2.   Coordinated Practices

The key insight of the economics of two-sided platforms in the oligopoly context is that to be successful cartels may need to coordinate on both sides. Consider the situation in which there are several competing two-sided platforms. If they agree to fix prices on one side only the cartel

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[33] See David S. Evans & Michael Noel, *Defining Antitrust Markets When Firms Operate Multi-Sided Platforms*, COLUM. BUS. L. REV. (2005).

members will tend to compete the supracompetitive profits away on the other side. This observation has two corollaries. The first is that it is harder to form an effective cartel in an industry with two-sided platforms than in single-sided industries, all else equal. The cartel requires more agreements and monitoring because of the additional side. The second is that if an authority finds evidence of a price fix on one side it should probably look carefully for evidence on the other side. This was relevant, as we note above, in the price fixing case involving Sotheby's and Christie's.

The economics of two-sided platforms is also relevant for evaluating the practices of cooperatives and joint ventures as we saw from the discussion of the *NaBanco* case. Payment card systems, financial exchanges, and music collecting societies are examples of two-sided platforms that are sometimes organized as not-for-profit cooperatives. The two-sided platforms adopt various rules and regulations for the members and take charge of certain centralized functions. The economics of two-sided platforms is useful for assessing whether there is an efficiency rationale behind an agreement over prices. In *NaBanco*, as we noted, the court found that the collective setting of the interchange fee helped balance the demands between cardholders and merchants (it helped internalize an externality) and eliminated the need for bilateral negotiations (it reduced the transactions cost of internalizing the externality).

6.3. *Unilateral Practices*

In trying to assess whether unilateral practices are anticompetitive the special economic features of two-sided platforms need to be considered.

Predatory and Excessive Pricing

Our review of pricing showed that a robust conclusion of the economics literature is that profit-maximizing two-sided platforms may find that it is profitable overall to price the product offered on one side below average variable cost, below marginal cost, or even below zero. The empirical evidence indicates that such below-cost pricing is common, occurs in stable market equilibrium, and is therefore not designed mainly for the purpose of foreclosing competition. Therefore, any presumption that below-cost pricing by two-sided platforms is anticompetitive is simply not valid. Of course, it is certainly possible for two-sided platforms to engage in predatory pricing by setting its price on one side so low as to deny other platforms access to this side of the market. It is also possible for a two-sided platform to engage in 2-sided predatory pricing, charging below cost overall on both sides with the purpose of foreclosing competitors. Cost-based tests make

some sense in the latter case, but it is hard to see how they could be used to analyze an allegation of one-sided predation.

Under Article 82 of the EC Treaty a dominant firm can be found to have made an abuse by charging "unfair purchase or selling prices." Just as a below-cost price on one side can emerge in long-run market equilibrium so can an above-cost price on the other side. Indeed, such below-cost/above-cost prices will come together. This issue has come up in a series of cases in Europe in which regulatory authorities have found mobile telephone operators to have charged fixed-line carriers "excessive" prices for terminating calls on their networks; the authorities recognize that the profits from these excessive prices are competed away in part through low prices for handsets and call origination. Indeed, the UK's Office of Communication (OfCom) recognized that mobile telephone platforms were highly competitive (on the mobile subscriber side at least) and did not overall earn supracompetitive returns.[34] Although they did not accept that this was a two-sided business, and did not apply two-sided analysis, OfCom did provide an "indirect network externality" kicker to the regulated price it imposed on the mobile termination side.[35]

Tying

Under a rule of reason analysis[36] the economics of two-sided platforms can provide an explanation for certain tying practices that seem to reduce consumer choice and harm consumers. As we discussed above, the platform provider designs the platform—including the constellation of services and features—to harness internalized externalities, minimize transactions costs between the customers and both sides, and maximize the overall value of the platform. As part of harnessing externalities this platform provider wants to increase positive indirect network effects while limiting

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[34] See, e.g., *Discontinuing Regulation: Mobile Access and Call Origination Market*, OFFICE OF TELECOMMUNICATIONS (OFTEL), Nov. 4, 2003, at §1.2, *available at* http://ofcom.org.uk/static/archive/oftel/publications/eu_directives/2003/discon1103.pdf, ("no mobile network operator, either individually or in combination with one or more other mobile network operators, has [significant market power] in that market."). No provider has a share exceeding 28 percent. See, e.g., *United Kingdom: Telecoms and Technology Background*, ECONOMIST INTELLIGENCE UNIT, Nov. 1, 2005.

[35] *Wholesale Mobile Voice Call Termination*, OFFICE OF COMMUNICATION (OFCOM), June 1, 2004, at pp. 163-172, *available at* http://www.ofcom.org.uk/consult/condocs/mobile_call_termination/wmvct/wmvct.pdf; See Armstrong, *supra* note 8.

[36] Economists and legal scholars generally agree that tying should be considered under a rule of reason analysis rather than a *per se* test. That is not the state of the law in the United States or the European Community both of whose highest courts have adopted something closer to a *per se* test of liability. However, both courts admit that efficiencies can at least play a limited role in the analysis (in the United States through the separate product test and in the European Union through the possibility of "objective justification" of the practice).

negative indirect network effects. As a consequence, the two-sided platform may impose requirements on side *A* that do not benefit them directly and which customers on that side might even reject after comparing private benefits and costs. But such requirements may benefit side *B*. And if the demand increases on side *B*, these requirements may increase the value placed on the platform on side *A*—and in fact could increase value so much that the feature provides a net benefit to side *A*.[37]

The honor-all-cards rule for payment cards is a possible example. Card systems generally require that merchants that agree to take the system's branded cards agree to take all branded cards that are presented by shoppers. Thus, merchants that have a contract to take American Express cards cannot decide to take payment by Amex corporate cards but not Amex personal cards, or to take payment from visibly wealthy travelers but not from locals. For at least some merchants the private benefit of this requirement outweighs its cost (generally we would expect that merchants would privately want a choice to take whatever card they wanted).[38] However, this rule makes the system's branded card more valuable to its cardholders, who have the assurance that their card will be accepted for payment at merchants that display the system's acceptance mark. By increasing the number of cardholders it makes the card a more valuable payment device for merchants to accept.[39]

Exclusive Dealing

The potential for profits on the other side provides a possible incentive for exclusive contracts in two-sided platforms. One of the main Chicago School observations about exclusive contracts is that a consumer is always free not to agree to exclusivity. The conclusion is that exclusivity in contracts must reflect consumers' judgment that the benefits (lower prices or efficiencies) outweigh the costs of only dealing with one firm. For two-sided platform businesses, it is at least possible that there is an externality; exclusive contracts on one side might help a platform

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[37] See Rochet and Tirole, *supra* note 6.

[38] For a discussion of this issue, see ROBERT E. LITAN & ALEX J. POLLOCK, THE FUTURE OF CHARGE CARD NETWORKS (AEI-Brookings Joint Center, Working Paper, 2006).

[39] A class of merchants claimed that Visa and MasterCard had illegally tied by requiring merchants that accepted their credit cards to also accept their debit cards. The card associations agreed to end this practice after a federal district court judge applied the *per se* tying test and ruled that the associates failed several prongs of this test as a matter of law. In re Visa Check/MasterMoney Antitrust Litigation, 192 F.R.D. 68 (E.D.N.Y 2000). American Express has been sued by a class of merchants for illegally tying its corporate and personal cards. See Lavonne Kuykendall, *Merchants Suing Amex Add Citi, MBNA as Defendants*, 170 AM. BANKER (2005).

gain market power on other sides. The consumers agreeing to the exclusive contracts on one side might, at least in the short run, gain from or be indifferent to exclusivity, but they may not take into account the costs to consumers on the other sides from decreased platform competition. Some recent work suggests that it is at least theoretically possible for a two-sided platform to use exclusive contracts to exclude competitors, although the welfare consequences of these contracts are not clearly harmful.[40]

As with exclusivity in one-sided markets, however, this can only be a concern if one firm has exclusivity over most or all of the market and if the exclusivity is persistent and durable. For example, consumers on the nonexclusive side could respond by moving to a competing platform, thus exerting pressure on consumers on the exclusive side to end exclusivity. Moreover, in markets with significant buyer concentration, the buyers would be reluctant to agree to exclusivity if there is some expectation that it will lead to dominance by that platform, as that will likely result in higher prices in the future for all sides. As with one-sided markets, one needs to consider whether the efficiencies from exclusive contracts— for example, in helping to create a platform that might not otherwise exist for the benefit of consumers— offset possible costs from reducing competition.

7.   Qualifications and Conclusions

The indirect network effects between customer groups served by a single business are strong in many important industries. Businesses in these industries operate two-sided platforms. The economics of two-sided platforms provides insights into how these businesses and industries behave that are relevant for competition analysis including market definition, coordinated practices, unilateral practices, and the evaluation of efficiencies. The economic literature provides robust results—that is, ones that are not dependent on only fragile assumptions—that can assist in this analysis. These results include the consequences of interlinked demand between customer sides for prices; prices do not, contrary to the standard model, have a tight relationship with cost.

As with almost any application of economics to policy several cautions are prudent. First, many of the theoretical results in the literature to date are, like those in other areas of industrial organization, based on quite abstract models of how industries operate and special assumptions of demand and cost. Second, to date there has been little rigorous empirical research on two-sided

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[40] See Mark Armstrong & Julian Wright, *Two-Sided Markets, Competitive Bottlenecks and Exclusive Contracts,* ECON. THEORY (forthcoming, 2006).

platforms or competition among them. Third, the theoretical and empirical work to date suggests that how two-sided businesses work is highly dependent on the specific institutions and technologies of an industry. One must be careful generalizing.